# AMERICAN INSTITUTE
OF
# CONSULTING ENGINEERS

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Proceedings of the Annual Meeting
Held January 17, 1938

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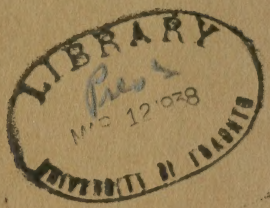


OFFICE OF THE SECRETARY
75 WEST STREET
NEW YORK

# AMERICAN INSTITUTE
OF
# CONSULTING ENGINEERS

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Proceedings of the Annual Meeting
held at the University Club,
New York City, January 17, 1938

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75 WEST STREET
NEW YORK

# ANNUAL MEETING

## of the

# American Institute of Consulting Engineers

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The Twenty-fifth Annual Meeting of the American Institute of Consulting Engineers, preceded by a dinner at 7.00 o'clock, convened at 9.15 o'clock, Monday, January 17, 1938, at the University Club, 1 West 54th Street, New York City, Mr. Edwin F. Wendt, President of the Institute, presiding.

The following members were present:

O. H. Ammann
George S. Armstrong
Howard C. Baird
R. E. Bakenhus
F. A. Barbour
George E. Beggs
Clinton L. Bogert
Albert M. Brosius
Henry Wolcott Buck
George W. Burpee
Montgomery B. Case
John N. Chester
J. F. Coleman
Hardy Cross
J. Vipond Davies
George S. Davison
Charles H. Dolan, II
Charles C. Egbert
James Forgie
Gavin Hadden
Alonzo J. Hammond
Shortridge Hardesty
Borden B. Harris
Philip W. Henry
L. L. Hidinger
W. W. Horner
John P. Hubbell
Harold W. Hudson
L. Alfred Jenny
Fred Lavis
Allen B. McDaniel
Frederick H. McDonald
Daniel W. Mead
E. R. Needles
George A. Orrok
Henry G. Perring
William M. Piatt
Carlton S. Proctor
Robert Ridgway
James F. Sanborn
Maurice R. Scharff
Frederick W. Scheidenhelm
Ole Singstad
L. J. Sverdrup
Edwin F. Wendt
Robert Spurr Weston
T. J. Wilkerson

There were also present the following guests:

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|---|---|
| N. M. Argabrite | Irving V. A. Huie |
| Walter D. Binger | E. J. McGrew, Jr. |
| Frank G. Breyer | J. L. Ferebee |
| J. J. Doland | H. S. Morse |
| E. P. Farnsworth | R. E. V. Roesler |
| Frederick M. Feiker | Frederick A. Snyder |
| A. Gibson | Leon E. Spencer |
| Richard H. Gould | William H. Standley |
| Charles Haydock | H. C. Tammen |
| H. H. Henline | George M. Thomson |
| Elwood Horton | S. L. Tyler |
| John C. Hoyt | Harold E. Wessman |
| R. V. Hyland | Fred C. Zeisberg |

President Wendt: The Annual Meeting will please come to order. The By-Laws in Article VII provide the order of business.

The roll-call has been completed by the Secretary.

The notice of meeting has been issued and read.

The printed minutes of the last Annual Meeting have been issued to the membership, and since there are no objections they stand approved.

The constitution provides that "three members shall be elected to the Council by the Institute each year." The ballots have been counted by the tellers, Mr. Harris and Mr. Hadden. They have reported the election of Philip W. Henry (applause), Henry G. Perring of Baltimore (applause), and Clinton L. Bogert of New York City (applause).

The new Council will meet at the Engineers' Club tomorrow (January 18) at 12.30 noon, for the purpose of electing officers—President, Vice-President, Secretary and Treasurer.

The business of the Twenty-fifth Annual Meeting has been completed, but there are a number of matters which I desire to present. My speech will be comparatively short.

During the past year the Institute lost four members by death: Charles Page Perin, Harrison P. Eddy, Daniel E. Moran and Hugh L. Cooper. I now ask that all members rise and pay a silent tribute to the memory of those men.

Dr. Perin was an outstanding engineer in the field of mining

and metallurgy. He was well known in India, China, Japan and Europe, as well as the United States. In 1932 and 1933 he was President of the Institute.

Mr. Eddy was an outstanding engineer in the field of sanitation and water supply, and was well known throughout the United States and Canada. In 1925 and 1926 he was Vice-President of the Institute.

Mr. Moran was an outstanding engineer in the field of construction, specializing in the design of deep foundations. He was well known, both at home and abroad. When the Institute was organized in 1913, he was named in the Charter as one of the trustees. In 1913-1916 he was a member of the Council.

Colonel Cooper was an outstanding engineer in the field of hydraulics and the construction of hydroelectric plants. He served his country in France during the World War. He was well known at home and abroad, and for seven years, 1928-1935, he was engaged in Russia on the construction of a monumental dam and hydroelectric plant.

Those men rest from their labors, but their good works will follow them. It has been said that "A man is as immortal as he is useful. He lives as long as the thing in which he has invested lives." They will live forever by reason of their engineering work for the public welfare.

I wish also to state that two of our members who ordinarily have been present at the annual dinners for many years are seriously ill. Col. Molitor, as you know, is the only living organizer of the Institute. The Colonel is quite ill. And Dr. Waddell, one of our most active members, is also seriously ill. I might take some time—which I will not do—to pay a long tribute to both of these gentlemen because I have sat on the Council with them and I know of their great interest in the Institute. But I shall simply suggest, and I think you will desire that the Secretary send to Colonel Molitor and Dr. Waddell our affectionate greetings.

It has been moved by Mr. Burpee and seconded by Mr. Singstad that the Secretary send to these gentlemen our affectionate greetings.

The motion was put to a vote and carried unanimously.

The Institute continues to gain in membership, and the Secretary's report shows that we had 120 members at the close of the calendar year. A net increase of five members is encouraging.

We balanced our budget last year and the Treasurer's report shows that there is a surplus for the first time since 1928.

The Council held ten regular meetings and gave earnest consideration to the affairs of the Institute. The following statement shows some of the principal actions which were taken:

*April:*

Ole Singstad was appointed to represent the Institute as a member of the Sectional Committee on Building Code Requirements for Excavations and Foundations of American Standards Association.

Messrs. Montgomery B. Case, Frederick J. Le Maistre and C. E. Myers were appointed as delegates to the forty-first annual meeting of American Academy of Political and Social Science.

*May:*

Council took adverse action on the Dollinger Bill in New York State Legislature which prohibited the employment of Consulting Engineers and Consulting Architects by State Bureaus.

Our Secretary, Mr. Henry, was the guest of the Association of Consulting Engineers of London at its annual luncheon meeting held at St. Stephen's Club, London, May 21, 1937.

*June:*

Mr. Henry, as a representative of the Institute, attended the annual Conversazione of the Institution of Civil Engineers, London, June 2, 1937, by special invitation.

Dr. Dugald C. Jackson represented the Institute as National Councillor at the annual meeting of Chamber of Commerce of the United States held in Washington, D. C., and presented a comprehensive report to the Council with valuable recommendations which were approved by the Council.

Malcolm Pirnie was appointed to represent the Institute in a conference on the Dollinger Bill held with the counsel to Governor Lehman. The Governor vetoed the Bill. Mr. Pirnie is entitled to congratulations.

Council of the Institute requested American Engineering Council to notify the proper congressional committees and other authorities in Washington that it is opposed to so-called make-work bills which, if adopted, would place an unreasonable financial burden on railroads.

*September:*

Council considered the question of competition by Educational Institutions, and expressed its views on the general subject of unfair competition. Copies of the report and action were mailed to 120 interested parties, including educational institutions, technical press, and others.

*October:*

Messrs. Frederick A. Burdett and Howard C. Baird represented the Institute in the matter of the model law for registration of professional engineers and land surveyors, and recommended certain modifications which were approved by Council. These modifications were agreed upon in conference with representatives of American Society of Civil Engineers.

*November:*

Council placed itself on record as opposed to the Black-Connery Bill on wages and hours, and the Secretary was directed to communicate this action to American Engineering Council, Chamber of Commerce of the United States, and the Chairmen of appropriate committees of Senate and House of Representatives.

*December:*

Council voted "aye" on three questions submitted in Referendum No. 72 of Chamber of Commerce of the United States in regard to regional authorities bills.

The Standing Committee on Professional Practice and Ethics submitted a report on the general question of unfair competition.

The Special Committee on Legislation considered a number of important pieces of proposed legislation, and made recommendations to the Council which were adopted.

The Special Committee on Development was actively engaged during the year on a number of matters, particularly the preparation of a brochure which will soon be issued, and the advocacy of the Model Law which has for its object the authorization of the employment of Consulting Engineers by states, counties and cities, for purposes of consultation, reports and advice.

Dugald C. Jackson, National Councillor, and Ezra B. Whitman, Substitute, represented the Institute in the Chamber of Commerce, U. S. A.

Fred Lavis, representative, and C. E. Myers, alternate, co-op-

erated with the Highway Research Board of National Research Council.

Edwin F. Wendt and Henry G. Perring represented the Institute in American Engineering Council. More than fifty organizations are now members of that national organization. The Institute has been active in supporting American Engineering Council as the representative of the engineering profession in matters pertaining to national legislation involving the public welfare.

During the year, Council continued its co-operation with the Securities and Exchange Commission.

The new charter approved by the people of New York City in November, 1936, provided for a number of fundamental changes in the government of the city, and Messrs. Robert Ridgway and George C. Diehl co-operated with the Mayor and submitted valuable suggestions.

The monthly meetings of Council were preceded by luncheons at the City Midday Club. The attendance varied from 20 to 40. After the luncheons, addresses were made on subjects of interest to the engineering profession, summaries of their addresses, in most cases, being sent to the membership.

### List of Speakers and Subjects at Luncheon Meetings During 1937

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|---|---|
| February 3: | Gen. Henry J. Reilly on "Personal Experiences in the Orient." |
| March 3: | Col. E. J. W. Ragsdale of the Edward G. Budd Mfg. Co. on "New Trains." |
| April 7: | Past President Fay on "Glimpses of the Near East." |
| May 5: | Charles H. Dolan, II, on "Air Transportation." |
| June 2: | Prof. Chas. F. Scott, Chairman, Engineers' Council for Professional Development. |
| September 8: | George C. Diehl on his recent trip through France, Italy, Germany and other European countries. |
| October 6: | Past President Burpee told of his recent trip through Egypt, Palestine and Greece. |

November 3: E. P. Warner on "Economic Position of the Airplane."

December 1: Dr. Dugald C. Jackson on his recent trip to Japan and China, where he lectured before various bodies.

On three different occasions during the past year, the luncheon meeting was addressed by speakers on the subject of transportation by air and rail, and this fact suggests that the field for engineers is constantly growing larger. Macaulay wrote almost a century ago:

> "Of all inventions, the alphabet and printing press excepted, those which abridge distance have done most for the civilization of our species. Every improvement in the means of locomotion benefits mankind morally and intellectually as well as materially, and not only facilitates the interchange of the various productions of nature and of art, but tends to remove national and provincial antipathies and to bind together all members of the human family."

Transportation in its broadest interpretation includes the railway, airway, waterway, roadway, telephone, telegraph, radio, wireless, television, and such other public services as the furnishing of gas, water and electric power.

The Institute is the only national organization of Consulting Engineers. It was founded December 12, 1910, as successor to the Association of Consulting Engineers, organized May 2, 1905. However, the certificate of incorporation was filed and recorded in the office of the Secretary of the State of New York, November 21, 1913. Questions are often asked: What is a consulting engineer? Why should there be a separate organization? What do the members get in return for the money invested? Why is it necessary to have so many different engineering organizations? These questions are pertinent. I think that there never was a time when Consulting Engineers were needed as at present. The increase in population, the great development of inventions, the crowding of more than fifty per cent. of the population into cities, and the demand for higher living standards, have resulted in social and economic problems which cannot be solved without the services of

the engineering profession. One of the objects of our Institute is to increase the usefulness of the profession to the public at large.

Who is a Consulting Engineer? Secretary Henry, on September 15, 1936, issued an extract from a publication of the Association of Consulting Engineers of London giving a definition which I quote:

> "A person possessing the necessary qualifications to practice in one or more of the various branches of Engineering who devotes himself to advising the Public on Engineering Matters or to the designing and supervising the construction of engineering works and for such purposes occupies and employs his own office and staff and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgment in the matters upon which he advises."

It would be difficult to improve this definition. A Consulting Engineer is a man who advises the public, designs public works, supervises the construction of engineering works, maintains an office, employs his own staff, acts as consultant or advises and executes, and is not interested in any activity such as would influence his exercise of independent professional judgment. I think it is a fair statement that engineers who are included by this definition have a right and a duty to associate themselves together in an organization such as the American Institute of Consulting Engineers.

The Association of Consulting Engineers of London prescribes certain qualifications of members such as (a) who shall be engaged in practice, (b) shall be of good standing, (c) shall be a corporate member of one of what we in America call the Founder Societies, (d) shall not be Chairman, Managing Director, or Manager, of any company carrying on any contracting or manufacturing business dealing with the class of work to which his practice relates, nor a partner in any firm carrying on such business, nor an agent for any company, firm, or person carrying on such business, (e) shall not be a director, employee, or agent for any company undertaking engineerng insurance work, (f) and shall not canvass for Consulting Engineer's work.

The Consulting Engineer is necessarily a highly trained professional man in the same sense as a lawyer or doctor, and he must

use his professional skill on behalf of his client in a similar manner.

Rudyard Kipling expressed a thought which pointedly indicates the activity of the Consulting Engineer:

> "I keep six honest serving men;
> They taught me all I know,
> Their names are What and Why and When
> And Where and Who and How."

There has been an interesting development which affects Consulting Engineers. The District of Columbia, as well as most of the states, recently enacted laws to provide for unemployment compensation. Rules and regulations relating to employers have been issued. The national act is known as the "Social Security Act," approved August 14, 1935, and the local act is known as District of Columbia Unemployment Compensation Act, approved August 28, 1935. The question may be asked whether the consulting engineer is an employee. If so, his employer, no matter where he may live or do business, is liable for the payment of Social Security Taxes.

The statute uses the term "contract of employment" and also the term "contract of hire" in describing the "employment" to which the Act refers. These are legal terms which describe the relationship ordinarily called by the law "master and servant." Therefore, the ordinary rules of law relative to master and servant will apply to questions as to who are employers and who are employees under this Act.

While the exact definition of "master and servant" has never been formulated because of the infinite variety of facts to which the term applies, it is well settled that the relationship exists whenever the employer retains the right to direct the manner in which the business shall be done as well as the result to be accomplished. In other words, not only *what* shall be done, but *how* it shall be done. This rule does not require that the employer shall actually direct the manner in which the business is to be done, but that he retains the right to do so.

Independent contractors are not employees. In general, if a person be subject to the control or direction of another merely as to the result to be accomplished in the work, he is an independent contractor.

A study of these rules and regulations warrants the conclu-

sion that Consulting Engineers are not employees in accordance with the terms of the law, and their clients are not employers liable for the payment of Social Security Taxes on the fees paid to Consulting Engineers. Stated otherwise, Consulting Engineers are professional men in the same classification as lawyers and medical doctors.

Occasionally a Consulting Engineer asks the question: "What do the members get out of membership in the Institute?" I always answer that they get out what they put in. Our organization provides a medium of co-operation for engineers engaged in a wide range of tasks crucially important to the general welfare. We consider matters of vital interest in accordance with the motto—

"In essentials, unity;
in non-essentials, liberty;
in all things, charity."

The Consulting Engineer is a professional man whose services, in my opinion, are needed just as much as the services of lawyers and doctors. The human family is subject to economic and social troubles, and doctors of engineering are essential. I often think that some of our Consulting Engineers are, in fact, Financial Doctors, because their services are largely required by financial institutions. Governments, national, state and municipal, as well as corporations, should require the services of Consulting Engineers in order to secure their independent professional judgment. The reports of independent Consulting Engineers are of the greatest value.

Goldsmith never wrote truer lines than these:

"Ill fares the land, to hastening ills a prey,
Where wealth accumulates, and men decay."

Gentlemen, I think that the American Institute of Consulting Engineers is doing a great work in behalf of the public. Thank you. (Applause.)

Now we have a very interesting program ahead of us. Let me say, in the first place, that our Institute includes consulting engineers engaged in almost every branch of engineering. We include in our membership military engineers as well as civil engineers. This evening we are going to hear from two eminent military engineers. I ask Admiral Bakenhus to present the first

speaker. In so doing I am glad that we have in our membership a representative who has spent his life in the service of the navy of our country—Admiral Bakenhus. (Applause.)

ADMIRAL BAKENHUS: Mr. President, it is a particularly pleasant duty that you have assigned to me. I do not know whether the membership realizes the extent to which the navy utilizes the services of engineers, civil engineers. Until I retired last October, I was an active member of the corps of civil engineers of the navy and we cover a field almost as wide, I suppose, as is represented in the membership of this Institute—not quite, but very wide—everything from dry docks to air-fields, power plants and hospitals.

I can perhaps be a medium to bring our guest speaker of honor—one of them—to the membership because of my experience in the navy, and it is through my service in the navy, of course, that I have come to know and to admire Admiral Standley. If I were to do the duty that is laid down for me, in the proper way, and tell of all that he has done, there would not be any time left for the speakers. So I must condense what I have to say.

In the first place, Admiral Standley graduated from the Naval Academy in 1895. He was graduate No. 2,203 from the Academy. Now the numbers run up to over twelve and a half thousand. So, in numbers, he dates back to the early days of the navy and thus covers a very important period of naval history. When he was graduated he stood at about the middle of his class; when he retired from the navy he stood at the very top—the highest peak which a naval officer can reach. His career covered all sorts of duties. I know that at one time he was executive officer of the U. S. S. Albany, later had command of the Yorktown, and later of the Battleship California, which was named after the state in which Admiral Standley was born and from which he was appointed.

He later became commander of the destroyer force of the battle fleet, and then commander of the cruisers of the scouting force, I believe, and then commander of the battle force of the United States Navy, which comprises the principal fighting elements of the fleet. That gave him, with his other experience, a well-rounded-out career and led to his appointment as Chief of Naval Operations with the rank of Admiral. In order that there may be no misunderstanding, in the navy we always speak of the

rank which he held as a "Full Admiral." There is nothing higher.

It so happened that during his tour as Chief of Naval Operations, the Secretary of the Navy was seriously ill for some time, and the Assistant Secretary of the Navy died at that time, resulting in Admiral Standley's acting as Secretary of the Navy for a period of a year. As such, he reported directly to the President and had not only his duties of Chief of Naval Operations, but he also had duties of Cabinet rank, representing the Navy Department.

He has represented his country in important armament conferences abroad, being associated with Mr. Davis at the most recent conference in London. All these experiences have made Admiral Standley one of the best-rounded, one of the most prominent naval officers we have ever had.

When he retired from the navy the New York World's Fair 1939 saw its opportunity and decided that it wanted Admiral Standley. He was made consultant and director of the foreign participation of the New York World's Fair 1939.

Now, Admiral Standley has made considerable sacrifice to be with us tonight, as I happen to know, as he had gone to Washington to attend the Alfalfa Dinner (laughter) or the dinner of the Alfalfa Club, I should say. I have never been at an Alfalfa Dinner, but I am sure one of the reasons Admiral Standley came here was that he would get a better dinner here than an Alfalfa Dinner in Washington. (Laughter.) Not only that, but it was carefully explained to Admiral Standley when he came here that he would meet the intelligentsia of the engineering profession, the cream of the engineering profession of the entire country.

It is not only due to the principles, but the exceedingly generous disposition and personality of Admiral Standley that has made him not only an able leader in handling the affairs of the navy, but many warm friends in the navy and with all with whom he comes in contact. I want to call my duty completed for the present and to present Admiral Standley.

. . . The audience arose and applauded. . . .

Admiral Standley: Mr. President, Members of the American Institute of Consulting Engineers, and my sponsor:

I am deeply sensitive and appreciative of the honor you have paid me in asking me to address such a distinguished society as this. After listening to Admiral Bakenhus I am reminded of a

story I heard told by the lady herself: A distinguished Virginia lady—widowed—went abroad and married wealth, position and estates abroad. She did not come back home for a number of years, but when she came back she brought an album showing pictures of the castle, the boxwood hedges, the garden, where they raised pheasants, the shooting lodges, where the Thames had been diverted in order to flow through the estate, the stables, the pictures of the beautiful horses that had won the derbies in England. Finally the old colored mammy, standing back of her, could constrain herself no longer and said, "Indeed, Ma'am, you done over-married yourself."

I feel, in the way of speech-making, that my sponsor has over-married himself.

Admiral Bakenhus first asked me to address this society on international affairs. I feel the only people who should speak on international affairs at this time are those persons who have full information, because sound decisions can be based only on the fullest information—and only those people sitting in the high places in Washington have that information.

These navy people are persistent cusses, however, and this civil engineer over here rather imposed upon me and said, "Well, isn't there something you could talk about?" And I said, "Well, for the present I am not talking about anything else than the World's Fair, you people don't want to hear about that."

He said, "Fine, we would be glad to hear you talk about the World's Fair." So that is what I am here for tonight, to tell you a little about the World's Fair. Incidentally, you might wonder how and why the ex-Chief of Naval Operations is associated with the World's Fair—why, after having spent forty-five years in the navy and having reached the highest rank in the service, and having done some of the things that the civil engineer says I have done, takes up with the World's Fair.

On the 31st of December, 1936, as Admiral Bakenhus has just said, one fraction before midnight I was Chief of Naval Operations in my own right. I was Acting Secretary of the Navy, and in the absence of an Assistant Secretary of the Navy, I was doing that job, too. The same fraction of a second after midnight I had no authority, no responsibility, no job.

I had served in Washington with a number of Chiefs of Operations. The one immediately preceding me, when he retired, I

used to go out and see. He lived in Washington. I found him either mowing the lawn, or raking leaves. The one previous to that used to come down to his old office in the General Board in the Navy Department, walk down every day to the office at the usual time, and sit down a few minutes, and then go back—go back home—passing the Offices of Operations as he went out. I didn't fancy a life like that.

Of course, I had my diversions. I play golf, I play bridge, I do a lot of things, but when diversion becomes a vocation, it is no longer a diversion. So I looked for something by which to taper off from a very active life in the navy to one of retirement—and the World's Fair came along, so here I am.

Of course, that gives me the subject of my talk tonight—the World's Fair. In order to save time I am going to read some of these extracts which will give you probably a better idea than I could if I tried to say them all to you. (Reading) "The New York World's Fair 1939, which will open on the 30th day of April, 1939, will be, in fact, an international exposition of unprecedented dimensions. This exposition has for its purpose the celebration of the 150th anniversary of the inauguration of the first President of the United States of America, and the establishment of the National Government in the City of New York.

"A joint resolution of Congress, approved June 15, 1936, reads in part as follows: 'RESOLVED, by the Senate and House of Representatives of the United States of America in Congress assembled, that the President of the United States be, and he is hereby, authorized and respectfully requested by Proclamation, or in such manner as he may deem proper, to invite foreign countries and nations to such proposed World's Fair with a request that they participate therein.

" 'AND WHEREAS, the President of the United States believes that the people of many nations would be pleased to unite with the people of the United States in participating in this World's Fair, President Roosevelt, in compliance with the aforesaid joint resolution of Congress, invited the participation of the nations of the world in this World's Fair.' " This invitation was extended to 68 countries, including international organizations.

I would like to digress there for a moment and tell you the results of that invitation. Many people have wondered why the World's Fair has to build buildings for foreign participation. We

answer, "The Bureau requires it." Their answer is, "Why did you get into the Bureau? Why are you under the purview of this Bureau?"

Now, in 1928, twenty-two nations of Europe met in a convention, the purpose of which was to discourage the holding of World's Fairs. The countries of Europe had gotten into the habit of holding World's Fairs very frequently and the other countries over there were sometimes called upon to take part in three or four different World's Fairs in the same year. So, in order to discourage that practice, which had become a racket, they met in this convention and agreed to abide by the convention's rules. They set up a bureau in Paris which was the c-ganization to administer the rules.

One of the rules of the convention was that none of these countries could accept an invitation to take part in a general international convention unless the Bureau gave them permission. The minute the President issued the invitation to the 68 nations, our fair became an international fair. The nature of our fair was a general fair—the very nature of—so our fair was a general international exposition, a fair and exposition over here being the same. Abroad it is different—a fair is an industrial fair, expositions are general. But our fair is a general international exposition.

Now, then, what happened? The first country, France, upon receipt of the invitation immediately went to the Bureau and said, "We want to go to New York. We would like permission to go to New York for their exposition." The Bureau then wrote to the president of the fair, "We have inquiries—France wants us to give permission to them—to enter the fair, but before we do that we have to know what your fair is, what your general regulations are, and we have to be sure that your fair will give the guarantees which our Bureau requires."

Now, the guarantees that those regulations require: In the first place, that was the first work that I was put on—to write the regulations for that Bureau. The first thing we ran up against was this—the fact that general expositions, international expositions, are of two categories only, a first and a second category. The first category is one in which the participating countries must build their own buildings. The second category is one in which the organizing countries, like the New York World's Fair, must build the buildings and provide the space in which the participating countries take part.

Time comes into the question also. We found we couldn't qualify as an international exposition, first category, because they only permit those to be held once in seven years. Brussels had held one in 1934, therefore, we could not qualify as a first category. Then we were limited to the second category. That was all right, we could qualify for that. Eventually, we did qualify as a second category fair—I wanted you to get that point clear and to show you why the New York World's Fair is committed to build the buildings and to provide the space in which the governments of foreign countries will participate. In other words, we are the hosts for Congress and the President of the United States, and we must provide a seat for all of the guests who care to come to our party.

The New York World's Fair 1939 will have for its theme, "Building the World of Tomorrow."

One of the young lady guides at the Administration Building said to me the other day, "Admiral, what is the World of Tomorrow?" and, who knows? But, I am sure you will agree that only by combining experience of the past with a knowledge of the present activities in science, arts, administration, industry, transportation, education, housing, etc., can we visualize the possibilities of tomorrow. This fair will result in a world-wide exchange of ideas; an observance of new processes and products; and a close contact and co-operation of the peoples of the participating states and foreign nations. In this connection it is important to bear in mind that New York itself has become an international center, and that in 1939, with this magnificent and interesting fair in its midst, the importance of this access to an exchange of information and ideas bearing on trade and commerce, science, art and cultural pursuits in general, cannot be overestimated.

I would like to paint the picture as I see it—the initiation of this fair site. I am just a country boy in the big city. I have been in the navy all my life and have seldom been in New York—only occasionally on a ship here in the Navy Yard. So I came to this World's Fair as a rank outsider.

I went out to look at the site and saw what was happening out there. Visualize, if you can, Flushing Meadows—New Yorkers can visualize it. It was originally a swamp—a mosquito-infested swamp—so much so that there were very few residents along and around the contour of Flushing Meadows. Flushing

Bay was originally a beautiful body of water, used 'way back in 1837 or thereabouts by the residents along the shore of that bay for boating and swimming and what-not. Flushing Meadows had some high land—or rather, table land—on it, and this was used as a dumping ground for Brooklyn and New York and various other places. Refuse and what-not was dumped there and it became known as the Flushing Dumps, and instead of being mosquito-infested, it became rat-infested, and odor-infested.

Sewage from Brooklyn was dumped into Flushing Bay and at low water the odors from there were terrible. They tell me that people passing there used to hold their noses at certain stages of the tide in order to get by. This mosquito-infested area, known as Flushing Dumps, was a nuisance and a menace to the people who lived in that community. Today you can go out and see what is happening out there—I will go on from there.

Human ingenuity and mechanical efficiency proposes, as if by magic, to turn an ash-dump into a veritable Fairyland of thousands of trees, hundreds of thousands of shrubs, fountains, lawns and numerous buildings in less than a year. During 1938 the site will be a beehive of construction. More than 300 buildings will rise on the site and miles of roads and walks will be laid.

A great city is being built within a great city to handle as many as 800,000 people in a day with comfort and all facilities except sleeping quarters. A minimum expectancy of 250,000 a day. Parking for 50,000 cars will be provided. Transportation facilities to handle 160,000 an hour by rail, boats, planes, autos and busses. Two great airports with transatlantic facilities are in the immediate vicinity.

I want to tell you a story there. I don't know whether or not you know about it—of course, you know, you have seen in the papers about the difficulties of getting North Beach Airport. We asked the Governor to invite the navies and the air fleets of the world to come to our fair. The invitation to the navy went through without any difficulty—they had to clear through the state and the Departments in Washington. Copies came to us and we found it was okay.

But there was a delay in the air, so I called up Washington by phone and asked what the trouble was. I was told, "We had to clear through the navy—the navy is holding it up." I said I wouldn't waste time over the telephone and that I was coming up.

I went to the Chief of the Bureau of Aeronautics and I said, "Cooke, why are you holding it up?" He said, "Well, since you ask, it clears through us and we have some responsibility in the matter. We would like to have some assurance that New York will have facilities for taking care of air visitors."

Now, I said, "Hold it up, and write a letter right quick that they will hold it up until New York has facilities to take care of the airport." Within a week North Beach was under way.

Flushing Bay will provide landings right at the Fair site. All types of conveyance service will be greatly augmented and organized to care for the increased traffic to the exposition. From the center of Manhattan it will be possible to reach the Fair within fourteen minutes. On the site where ashes stood heaped to the height of 60 and 70 feet, now stand many of the big exposition buildings. The seven million cubic yards of ashes that were removed would build a four-width road from New York to Miami, Florida. Two beautiful fresh water lakes were made from the jagged creek that went through the site.

I think there is a little romance about that, too. This stream that went through Flushing Meadows looked like a Chinese serpent winding through. When the tide was up the salt water came up and overflowed the meadows. The result was that this area was permeated with salt and alkali. They have scooped this out and have made two beautiful lakes there about six feet deep. The plan was to use this dirt which was scooped out—which is very rich soil, if it were not for the ashes and alkali—to spread over the areas that have been graded off, in order to give them a surface so that grass and trees would grow.

They found that nothing would grow in that soil, so you will find it in windrows where it is being treated, aerated, so eventually it will be used for a coat and covering for the Flushing Dumps which are now being leveled off.

The Fair will not lack for gaiety or color—and so, the romance of the Fair.

Before the nine gates open on April 30, 1939, a vast fortune will have been spent in preparing grounds, erecting buildings and exhibits and the employment of perhaps 100,000 men and women. It is estimated that this expenditure will approximate 150 million dollars, so you will see that the New York World's Fair is BIG BUSINESS. Fifty million persons are expected to pass through

the gates from April 30 to November 1—a conservative estimate. World-wide participation is assured, 56 foreign nations and 31 states have signed for their participation, which will represent an expenditure of 20 million dollars to place their exhibits before you to visualize when you visit the Fair.

The first message sent over the telegraph wire, I think—if I recall it correctly—was, "What has God wrought?" I am sure that any one of the fifty million visitors when he first looks upon the beauties and wonders of the New York World's Fair will exclaim, "What has man wrought?"

Now, in conclusion, Mr. Chairman, I want again to thank you and the members of the Society for your kind attention and for the pleasure of being with you here this evening. In behalf of the World's Fair, I would like to send to each and every one of you an invitation to visit the site on Flushing Meadows, and I am sure you will be astonished at what is going on out there. Thank you very much. (Applause.)

President Wendt: In behalf of the Institute I wish to say to Admiral Standley, we feel honored in having you as our guest, and we extend to you our hearty thanks and best wishes.

Now, gentlemen, we have another speaker, who comes from the United States Army—the other branch of the military service. Colonel Gibson is Chemical Officer of the Second Corps Area on the staff of Major General McCoy, with headquarters on Governors Island. He was born in Iowa. At present he holds many medals for distinguished service and has received honors of all descriptions.

In 1898 he entered the Spanish-American War as a private and went to the Philippines—at the age of 18. When he returned from the Philippines he entered West Point, through a competitive examination. In 1905 he was graduated from the United States Military Academy. He rose through the various grades and became a Colonel of Coast Artillery during the World War. In 1917 he entered the World War—actually on the other side of the water—and was appointed to the General Staff at General Pershing's headquarters in France.

He received the Distinguished Service Medal for World War services.

In 1921 he was transferred from the Coast Artillery to the

Chemical Warfare Service and has served since the World War on the War Department General Staff in Washington, in the office of the Chief of Chemical War Service, as Chemical Officer of the Philippines, and as Chemical Officer in Texas at Fort Sam Houston.

He is a graduate of the Army War College, the Command and General Staff School, the Chemical Warfare School, and a distinguished graduate of the Coast Artillery School, and is on the General Staff of the United States Army.

Gentlemen, it is a great pleasure to have as our guest, Colonel Gibson, who will now address us.

(The audience arose and applauded.)

Col. Gibson: Mr. Wendt, Admiral Standley, and Members of the Institute: When the Admiral was speaking, I was thinking of what is credited to Emerson, or possibly John Wesley: "What a man is often speaks so loudly that you can't hear what he says." Well, I believe we did hear what the Admiral said intellectually about the World's Fair, but what the Admiral is and what he has done and what he stands for as exemplifying the spirit and efficiency of the navy, as we of the army, and, I believe, the American citizens know it, meant more than what he says. I feel almost like giving three cheers when I see the Admiral standing before an audience. The last time I saw him he was going to London to attend one of the several conferences there, and some of us this evening remarked that we should very much like to have the Admiral give us an unexpurgated statement of what happened there. (Laughter.)

Will Irwin, writing during the World War about seeing a Highlander going by in France, said that this Highland officer impressed him like band music going by. Well, I feel somewhat that way when I see Admiral Standley stand up. I am not saying that in the sense of a junior officer flattering a senior. I feel about him that way—and about the navy as a whole—a feeling of confidence that we, and, I believe, the whole American people, have in the navy at this critical time.

There is one thing about the navy that corresponds to your experience here as consulting engineers—you have to actually put in practice day by day and week in and week out the theory that

you study. In the army, unfortunately, we can't put in practice very much of our theory until war comes. In the navy the junior officers go down in submarines or command many of the small ships and, as they rise in rank, have other more important independent commands. They are in time of peace actually doing the things they will do in war. They must exercise sound judgment, for if they don't, disaster follows, or some other result that penalizes bad judgment. That is a tremendously fine experience to develop commanders.

It is the same thing in your profession. If you make your calculations wrong, you will soon find out. The bridge won't stand up, or whatever you are trying to do will not come out the way you planned it. We in the army have less opportunity to test our theories. We are frequently talking theoretically, and we don't know whether or not our theories will work practically. We are doing as much as we can to apply and test these theories, but we are in a very difficult situation.

I have a special feeling of pleasure in talking to men who have had to test their theories and who have had to think clearly and accurately, who, if they had not done so, would not be here—the circumstances would have seen that they would be punished or that they would have failed in whatever they undertook. They would not be in this profession—wouldn't be in the room here to-night. When I try to tell you some of the things that I think everyone should know about the chemical phase of our national defense organization or preparation, I know that in so far as clear, logical and objective thinking minds can comprehend, that you here will do so to a greater extent than almost any group before whom I have had the opportunity of trying to present these facts.

There are certain facts concerning chemical warfare which, I think, every citizen should know, whether he is connected with the army or not. There are many of you who are directly connected with or are officers of the army. All of you are very directly interested in our national defense scheme and system. You all agree that it should be as efficient as possible and be based upon sound and logical reasoning.

In deciding what I would attempt to present to you, I tried to put myself in your position and from that position to determine those things which I would like to know about chemical

warfare. What I am going to state to-night, I think, are facts, or reasonable conclusions that I may draw from those facts—but in the main they are facts.

To start on our subject of chemical warfare. The reason that chemicals were and are used in war is that man from early days in using force against an enemy has made use of whatever his natural resources, his development in art, science, industry and his inventive ability made available. When the chemical industry reached a suitable point of development, chemicals became a weapon of war. The Nobel Prize winner in physics, Millikan, stated that the arms race began many thousand years ago, when a fellow picked up a stone and threw it and found that, instead of biting a man in the neck, or hitting him with his fist, he could reach him at a greater distance and do more damage with a missile. That is when the armament race, or the struggle for improved methods, and competition as to means of carrying on war, began. And we have been keeping it up ever since.

In each successive period of fighting, during the centuries, man has made use of whatever was made available by his natural resources, his ingenuity, resourcefulness, and his inventive ability. Each markedly new development in technical means of warfare was decried as tending to make war more inhumane. However, he has been no more cruel or inhumane in these later periods, than he has been at previous periods—it hasn't been that at all. He used chemicals as a weapon in the World War because he had a chemical industry that made chemicals available. The reason chemicals were not used before the World War is that chemicals of suitable types and sufficient in quantity were not available in any previous war.

I have here this evening—perhaps somebody will be interested in seeing it—an extract which I took from the *War of the Rebellion,* official records of the Union and Confederate armies, a paper in which General Pendleton, Chief of the Artillery of the Army of Northern Virginia, asked General Baldwin, Chief of Ordnance, if he could furnish him some gas shells, or stink shells as he called them. General Baldwin replied that he was unable to furnish stink shells. Here was General Pendleton, in the Army of Northern Virginia, who wanted to suffocate the opposing troops, but couldn't do so because the chemical industry had not then been developed to that point. The Army of Northern Virginia was

just as anxious to use gas as the Germans were later, but failed in initiating chemical warfare through lack of means, but not of intent.

I have next to me a representative of the duPonts who may check me. I am not an expert chemist. I have only the chemical knowledge gained in West Point, followed by a little chemical instruction afterwards at Edgewood Arsenal. My duty is mainly to supply the military knowledge of this particular type of fighting, an understanding of how the chemical weapon may be used in battle and of how best to defend against it. The history of the development of the chemical industry shows that the industry had not reached a point in any major war before 1914 where chemicals, as weapons, other than explosives, could be furnished in quantity on the field of battle.

The modern chemical industry grew up in Germany after the Franco-Prussian War, and the World War was the first war in which a great chemical industry was available to furnish war materials. Before that time there had been suggestions by Lord Dundonald of the British Army for the use of chemicals to gas out the Russians in the Crimea; and suggestions as to the use of gas shells (as previously told) in the Civil War; but adequate means to carry out these suggestions were lacking.

In the winter of 1914 and 1915, when the two sides were stabilized with one flank on the sea and the other on Switzerland—both sides had dug in, as you know, using barbed wire, and were beginning to use concrete. There were not enough artillery munitions available then to blast each other out as they were in part able to do later. There was a stalemate. The question came up as to what they could do to break that stalemate. Of course, both sides were doing their best to solve that problem. The Germans had the better of it because they had a means which the Allies did not have, a great chemical industry.

In the early part of the war, Professor Haber, as you know, had already introduced chemical warfare, if we use the term chemical warfare wherever chemistry is a dominating factor. As a matter of fact, chemical warfare has been existent since the time of the invention of gunpowder. In 1914 the Germans had nitrates for only about five months' fighting when they were cut off from the Chilean nitrate fields by Von Spee's squadron being wiped out at the Falkland Islands by Admiral Sturdee's fleet. Without addi-

tional supplies of nitrates they could not have carried on for more than five months.

Well, the Haber Fixation of Nitrogen Process had been pretty well developed by 1913 and the Germans now concentrated on improving it and as a result were able to carry on because they were able to manufacture by this process the nitrates that were necessary. But, if it had not been for Haber, and his fixation of nitrogen process, they could not have carried on for more than a few months—as England had command of the sea.

When the lines stabilized, Haber was called on again. He was the head of the Kaiser Wilhelm Institute and the outstanding scientist and chemist in Germany. I don't know whom he corresponds with in this country—he was the dean of their scientists over there.

Professor Haber suggested, since they had chlorine—quantities of it, tons of it—that they were using in industry, that they take this stuff in cylinders, in the same cylinders in which it is shipped about in industry, up to the trenches. When the wind was toward the enemy the cylinders would be opened and the gas allowed to drift over the enemy lines. They could thus break the stalemate. The molecules of gas would shoot around corners and into dugouts where the men could not be reached with projectiles.

The German General Staff was at this time preparing for the successful Tarnow-Gorlice break through on the Eastern Front which occurred on May 2, 1915. The Germans were anxious to conceal the fact that they were preparing for the break through by the shifting of troops to the Eastern Front. For purposes of deception, they asked for lively activity on the Western Front with no serious actions. When Haber made his suggestion, therefore, the German General Staff concurred in it, but not whole-heartedly or with any idea that it was of any serious consequence or would accomplish very much. To keep the French and English occupied was their main objective by this attack.

The gas attack (generally called the first gas attack, although several gas attacks had previously occurred on the Eastern Front) was a secondary operation. There are a lot of details in connection with it, including the length of time it took until the wind was favorable. But the essential fact is that on the 22d of April, 1915, these cylinders—several thousand of them—on a four-mile front were opened up and the gas cloud was allowed to drift down

against the Allied troops holding the salient. The British Fifth Corps held most of the Ypres salient, with the Canadian division occupying the northeastern part of it and the British the eastern and southeastern. The northern part was held by the French. They had in line the 87th territorial division, men in the forties or older, and the 45th Algerian division; this latter division being made up of black troops with some stiffening of white troops among them. The gas attack came against these two second-rate divisions.

Well, these two divisions gave way completely, as you know, and opened up a gap four miles wide. The German troops making the attack were second-rate troops. You know all divisions in France were rated according to their previous training and fighting records. These German troops were second-rate troops by such rating. There were not sufficient reserves at the disposal of the German army commander to push through and enlarge the gap when it was once made. These second-rate attacking troops settled down about seven-thirty in the evening, entrenching. They had penetrated to a depth of about three and a half miles. Their advance over the rough terrain had broken up organizations and tended to demoralize them. About midnight a counterattack (unsuccessful) was pulled off by the Canadian troops. The fighting went on then intermittently for about a month after that, with artillery, rifles, and machine guns, interspersed with gas attacks. The salient was eventually reduced in size, but never wiped out.

That was the first gas attack. The Germans had a chance there of pushing through to the channel ports—if there had been reserves and if they had really exploited adequately that first surprise attack. After that, both sides mobilized their chemists, both for protective and offensive purposes. The Allies first mobilized scientists for protective purposes. They sent over to France on a destroyer Professor Haldane, of Cambridge University, one of the great scientists of England, the father of "J. B. S." of the University of London, a present-day authority on chemical warfare. The gas was identified as chlorine and the type of protection required determined. The next several nights they had millions of women in France and England working on an improvised gas mask, a pad soaked in bicarbonate of soda or some other alkali to neutralize the chlorine. That was the first thing to be done—to get these scientists and the women of the two countries to protect the

soldiers. Afterwards, each side started working to find out what gas it could develop that would be harmful to the other side and to anticipate with protective measures the gas an enemy might use. That was the initiation of chemical warfare.

Before the so-called first gas attack at Ypres, on April 22, 1915, the Germans had tried gas on the Russians, who suffered terribly. We don't hear very much about that. Whole regiments were wiped out—they didn't have any protection at all. Little was known on the Western Front about the gas attacks against the Russians. Therefore we don't even now give them much consideration when we talk about the first gas attack. This shows how the world tends to overlook the suffering of the Russians. The gas attack to which we pay particular attention, because it was brought home to us on the Western Front, was on April 22, 1915. This was a signal for both sides to mobilize the chemists of the world. For example, we had Dr. Conant, the President of Harvard University, as one of our chemical warfare officers.

I was not in the Chemical Warfare Service at that time, but it is a matter of record that they had practically all our outstanding chemists engaged on chemical warfare work. It is a very interesting thing now, in light of the fact that you hear these tales and you see these scare-headlines about new gases which have been discovered that will revolutionize war and wipe out populations.

It is very interesting to inquire how many new gases were discovered during the World War with practically all the chemists of the world working on this problem, with all the facilities and money they could use at their disposal. I often ask somebody in the audience if he will just make an estimate in order to add interest to the talk. How many would you say they discovered with practically all the chemists in the world working on the problem?

MEMBER: Fifty.

COL. GIBSON: They didn't discover one which was developed to the point where it was used in battle. It is true Professor Lewis of Northwestern did discover what is now called "Lewisite." Here is some Lewisite, so-called "dew of death." Professor Nieulands of Notre Dame worked on that first. I believe he also did the fundamental work on artificial rubber, as well as the fundamental

work on this Lewisite. However, it was not brought to a point where it could be used in war.

There was absolutely no newly-discovered gas brought into use on the battlefield—with all those chemists concentrating on the problem—not a single chemical was used in the war effectively that had not been known for at least a quarter of a century before the war. It is just not an easy matter to develop a chemical that can be used effectively in war. The conditions, the restrictive conditions, governing the use of chemicals are so great that it is not by any means sufficient to discover a chemical that will kill or injure men. That is a far cry from getting something that will be useful in war.

I believe it will be interesting for you to go over with me the absolute requisites of a chemical warfare agent. A substance to be useful as a chemical agent must have all of the following properties:

*a.* It must be very toxic; or very irritant; or produce a large volume of smoke; or have incendiary properties.

*b.* It must be stable in storage and reasonably stable in contact with moisture.

*c.* It must be capable of manufacture on a large scale.

*d.* Raw materials must be available in the Continental United States.

*e.* It must be suitable for loading in munitions and should have little or no corrosion on ordinary steel.

*f.* The substance must be capable of vaporization, or other means of dissemination, in sufficient concentration under field conditions to produce the effect desired.

*g.* If the substance is a gas under ordinary conditions, it must be easily compressed to a liquid and easily vaporized when the pressure is released.

*Additional Desirable Properties.*—In addition to the absolutely necessary properties, it is highly desirable that a chemical agent possess the following properties:

*a.* It should be capable of handling and transportation without special precautions.

*b.* When disseminated as a vapor the molecular weight should be several times as great as air (which is approximately 29).

*c.* It should be cheap to manufacture.

*d*. It should be capable of quick production in existing commercial plants without extensive alteration in existing equipment.

One of the gases that a person would first think of for use in war would be prussic acid, because, as often stated in laboratory instructions, one whiff of it will kill a man. This is an exaggeration, but it is true that very little hydrocyanic acid will put you out. Well, the French tried prussic acid. They fired thousands of artillery shells loaded with it. The difficulty in making it effective is its volatility. As soon as you begin firing it the enemy gets out of the way of the shells—he moves promptly from where they are hitting. Naturally, soldiers won't stand there to breathe the atmosphere at all—they seek shelter where the shells won't be effective. The gas evaporates quickly. To force any large number of the enemy to breathe this gas was, therefore, out of the question. It was a theoretical proposition. The wind takes it away rapidly, the explosion takes it away, and soldiers leave the vicinity. Its tactical use was ineffective and was discontinued.

Just about one year ago you probably heard that Professor Barcroft, a noted British scientist, was over here—*Time* magazine carried an article about him, and some of you in scientific circles may know about him and his experiments and discoveries. He was experimenting at that time with the effects of temperature on the body by putting himself into a refrigerator and reducing the temperature to see what the effect would be, first on his body and then on his mind, of extreme reduction of temperature. That is one of the things he was talking about in his lecture here. During the World War he was working on chemical warfare problems and said, "I don't believe that this prussic acid in field concentration will kill soldiers. You are experimenting on dogs. Men will not be killed as readily as dogs. I will take a dog into this glass case with me and you may raise the concentration up to the point where it kills the dog, and I will bring him out, without material injury to myself." So he went into the glass case. Remember, this was during the war, when taking risks was a normal experience. They put the concentration up to the point where the dog went out and then Barcroft came out alive, dragging the body of the dog. He was all right, except he said that his head hurt him for about a year thereafter. (Laughter.) But he came through alive and was over here not many months ago giving a lecture on further experiments and other tests that he is making on the

human body, his body. This is an outstanding and dramatic illustration of what risks scientists have taken and are now taking in the interests of national defense along chemical lines.

Chlorine was the first gas used during the War. Now, chlorine has to be compressed to about 100 pounds per square inch in order to become a liquid in the container in which it is used as a munition. Without liquefaction it couldn't be used as a munition. I might say that it is interesting—one of those G. K. Chesterton paradoxes—that the one thing the gas service cannot use and never has used is gas. The chemical must be in a liquid or a solid form in the chemical munition. You can't get enough in the container unless it is a liquid or a solid. It may become a gas afterwards, but while being handled by soldiers it is not a gas.

For instance, carbon monoxide—odorless, tasteless and colorless—would seemingly make an excellent war gas. People go into their garages, turn on their car motors, and put themselves out of commission with it. It is thus a highly toxic gas. The trouble is, you can't get men to do that on the battlefield. To use it in battle you would have to have it liquefied and put into artillery shells and you would have to do this in great quantities. But you can't liquefy carbon monoxide except at tremendously high pressure and extremely low temperature. You can do it in the laboratory, but you can't do it industrially. So you can't use it in war because you can't liquefy or solidify this gas by industrial means.

The next chemical agent that was used after chlorine was phosgene. I haven't any phosgene here. It has somewhat of a pressure. I might have brought a glass tube of it, but if it broke inconvenient results might follow. (Laughter.) That was the gas that was used after chlorine. It is more toxic than chlorine. It was put in a cylinder; chlorine mixed with it to give it pressure—the phosgene has not enough pressure to drive it out of the cylinder under its own pressure. Just as with chlorine, the first use of phosgene was by allowing it to drift down over the enemy as a cloud.

The first big gas attack that the British put on was in September, 1915, at the Battle of Loos. Sir Douglas Haig was in command there. Chlorine gas was used from cylinders in a cloud gas attack.

When the decision to attack at Loos was definitely taken, Haig's first intention, to curtail his commitment and probable loss,

was to attack at first with only two divisions. But a too-successful demonstration of the possibilities of chlorine gas projected in a "wave" from cylinders led him to modify his views, and to believe that if the wind was favorable the gas discharge might even procure "decisive results" and justify him in attacking on the wider frontage of six divisions—Rawlinson's IV Corps (47th, 15th and 1st Divisions) on the right, or south, and Gough's I Corps (7th, 9th and 2d Divisions) on the left.

With sound judgment of the chances, Haig urged that "under no circumstances should the forthcoming attack be launched without the aid of gas," but he was overruled by French and Foch. He then obtained permission to reserve his decision until the last possible moment and to let the choice—between the large or limited attack—depend on the weather conditions. By the irony of fortune, the wind was most favorable for the use of gas on September 15, the day originally fixed by Foch for the attack, and this fact encouraged Haig's hopes. But the retention of a dual plan led to a distribution of the artillery on the whole army front instead of concentration on one-third.

Over five thousand cylinders of gas, containing nearly one hundred and fifty tons, were carried up to the front trenches and safely installed in special recesses, without one being hit by enemy fire. Even so, there was barely half the volume of gas necessary to maintain a continuous flow for the forty minutes that, in turn, were considered necessary to outlast the protective power of the oxygen apparatus used by the enemy machine-gunners. Hence the cylinders had to be turned on and off intermittently. Smoke candles were used in the intervals to simulate gas, and, at the end, to form the first smoke screen of the war.

The last night was a time of tense anxiety. Repeatedly Haig studied fresh charts sent in by a chain of meteorological observers. At 6 p.m. the forecast was that the wind would be "on the borderline between favorable and unfavorable, with a slight bias towards favorable." At 9 p.m. the forecast was better, indicating a probable change to a southwesterly or even westerly wind, which would carry the gas over the German trenches. Thereupon Haig unhesitatingly ordered the full-scale offensive with gas, although as a precaution staff officers of each corps had been ordered to stand by their telephones. At 3 a.m., after a further report not quite so encouraging, he fixed sunrise (5.50 a.m.) as the hour for releasing

the gas. During the hours of darkness the wind changed as predicted, but only as far as southwest, and, worse still, was so slight as to be almost a calm.

About 5 a.m., as soon as it was light, Haig went out. He could feel only the faintest breath of air, and he asked his senior A. D. C. to light a cigarette. The smoke drifted in puffs to the northeast.

Did it justify the venture? Would the gas merely hang in the British trenches? A slight increase of wind was felt and at 5.15 a.m. Haig gave the decisive order to "carry on" and climbed his wooden look-out tower. But the improvement was delusive, and a few minutes later one of his staff telephoned to the I Corps to ask whether it was possible to stop the discharge and the attack. For this emergency the gas officers had made ample arrangements. But Gough replied that it was too late. If it would certainly have been a close shave, one may suspect, especially in view of Gough's record, that with this ardent fighter the wish was at least the midwife, if not the father, of the thought.

When the gas was actually turned on at 5.50 a.m. it carried fairly well over the German trenches on the right, if too slow and slight for full effect, but on the left was a failure, in some places drifting back and upsetting the attack.

Where the gas drifted over the German lines, they got forward pretty well, but the attack in the main was a failure, with heavy losses to the British.

After that they developed a method of throwing the gas over into the enemy's lines, so they would not have to depend on the wind. You can see the great disadvantage of the cylinder attack, not only in having to depend upon the wind, but due to the heavy task involved in bringing up and installing the cylinders. It took about 8,000 men to bring up and install the cylinders for the Battle of Loos. Sir Douglas Haig said it was the hardest work the men had ever done. The cylinders weighed about one hundred pounds each and were awkward to handle, especially in the trenches.

The final development on both sides was that they put the chemical in liquid or solid form into artillery shells and fired the shells over. That is the way that most of the chemical attacks were put on during the War. The greatest part of the gas that was used during the War was fired in artillery shells. They used

the ordinary artillery shell. The only change in the shell was the type of thread on the plug that closed the shell, which was designed to prevent the escape of gas.

The great disadvantage, from an engineering standpoint, of putting over gas in artillery shells is its inefficiency. For example, in the British 18-pounder shell you get only about a pound and three-quarters of gas. In the French 75 m.m. shell you get only a pound and a quarter of gas. You must thus send over an immense amount of metal to get over a relatively small amount of gas—a quite expensive and inefficient method from an engineering standpoint. In 155 m.m. shells, six-inch, you get about twelve pounds of gas per shell—a larger amount of gas proportionately than in the smaller calibres. But still with all calibres it is a very expensive and relatively inefficient method of putting the gas over. However, that was the principal method used, and was used right up to the close of the War.

You might say, "What effect had the use of gas on the War as a whole?" Well, I don't know. Nobody in the world knows. It had no decisive effect. However, it came near having a decisive effect in the first gas attack of April 22, 1915.

You remember that, starting with March 21, 1918, the Germans made their first break through at St. Quentin against the British Fifth Army and part of the British Third Army, in their attempt to go through to Amiens. They got almost to Amiens, where the railroad was. If they had cut the railroad at Amiens, they would have separated the British from the French.

The situation was very serious for the Allies. I remember I was with the British General Wagstaff at our General Headquarters. He was always cheerful and always had a smile and a joke, but this was one time when General Wagstaff could not smile. I said, "How is John Bull to-day, General?" I used to go to his office to give him the strength of our forces and to get the strength of the British forces. He said, "John Bull, is pretty groggy today, and I do not know what he is going to do."

"Well, what do you think is going to happen?"

"I guess they will drive us back on the channel ports and separate us entirely from the French, and then try to defeat each of us in detail. We have just got to make the best of the situation." That was the first time I saw General Wagstaff without a smile and without a very optimistic view-point.

But the Germans didn't do it. They did not get to Amiens. They made five major offenses that summer, ending with the final offensive on July 15 to enlarge the Chateau-Thierry salient. Our troops took an important part there. This final offensive failed and Germany was on the defensive thereafter.

In every one of the five major offensives, by far the major portion of their artillery fire was chemical fire.

On May 27, 1918, as you will remember, the Germans broke across the Chemin-des-Dames after about three hours of artillery preparation. That was the advance that ended up at Chateau-Thierry—it formed the salient with Chateau-Thierry as its apex. They marched the first day about twelve miles—that is about as far as they would march if they did not have any opposition at all. There were several British divisions put in at the Chemin-des-Dames sector alongside the French, in order to rest up, because it was a quiet sector. And that is where the Germans broke across again. It proved to be anything but a restful sector.

Colonel Bruchmüller is the German officer who was the impresario, the Toscanini of those artillery fires in the five major offensives. He was shifted from one group of armies to another to plan and to stage the artillery fires of the successive offensives. He was thus the recognized expert in staging these artillery fires in preparation for a break through. He has written two or three books on those operations and I have translated from one of them a table in which he tabulates the types of shells, whether gas or high explosive and the number of each type, laid down at each battery for the Chemin-des-Dames offensive. The far greater proportion of the shells were gas shells. I don't know, and nobody knows, what effect that gas had. There were so many other factors which had to do with the German victory at the Chemin-des-Dames—so many other factors came into play there that it is impossible to correctly weigh or evaluate any one factor.

The important conclusion is that the Germans, after three and one-half years of fighting, had great faith in chemicals, and they used chemicals as the preponderant part of their artillery fire in their last five major offensives, their final throw of the dice of war.

Now, we used relatively little chemicals in the war, because we had relatively little to use and in turn had relatively small amounts used against us. We had, as you know, about 265,000 casualties from all causes. Seventy thousand of these were gas

casualties. This in spite of the fact that relatively small amounts of chemicals were used against us. The Germans had used most of their chemicals in those five major offensives ending on July 13, 1918, and when we came in after July, 1918, their ammunition dumps contained a relatively small amount of chemicals. So the American forces did not face the situation that faced the other troops as regards the amount of chemical fire that was used against them. We must guard against drawing wrong conclusions from this fact.

Now, the principal chemical that was used during the War was mustard gas. I have here a chart; I hope you can see it clearly. The chart shows all the British battles and the gas casualties suffered in each battle, giving types of gas and kinds of weapons used in disseminating it. The British gave it to us as a confidential chart; it is no longer confidential. When I explain this chart, you can see what I am driving at, because of the color scheme. At the top are the battles, by dates, and these graphs in color show the gas casualties that they suffered in each battle, a distinguishing color for each type of gas and gas weapon.

This heavy line here shows when gas was first used on April 22, 1915. They suffered tremendously there. This green down here shows the phosgene period. The losses are relatively slight. In July, 1917, the Germans started to use mustard gas, and this yellow curve is the mustard gas period. In other words, of all the casualties that were produced during the War, by far the greatest proportion were produced by mustard gas. Mustard gas is, as far as we know, the gas that will be used in any future war. This chart shows very markedly that casualties from mustard gas far exceed casualties from any other type of gas.

This fact has a good many lessons for us. Here is mustard gas (holding up a small bottle). It is a dark-colored liquid looking like dirty gas-engine oil. It produces casualties by burns on the body due to the liquid contact or to the gradual action of the vapor. The ordinary clothes or uniforms do not protect against it. If I threw a little of the liquid down here on the floor near your Chairman, tomorrow he would probably be blistered under his armpits, around his neck or wherever else the skin is moist and therefore most readily attacked. The blisters would be caused from the vapor that would gradually be evolved from the liquid. It would vaporize about as readily as dirty gas-engine oil thrown on the

floor here. The burns would probably not be severe, but would take several weeks to heal.

Mustard gas had been experimented with in the laboratory in 1860 in England and in 1883 by Victor Meyer, a German chemist. Now, the Germans, going over their chemical data, looking for suitable chemical agents, must have stumbled on to Victor Meyer's notes and from further experiments determined that they had in that chemical a suitable war gas. What they did was to go through all their records to discover anything that gave promise of being a war chemical, and in doing so they ran across Victor Meyer's experiments and found that here was a substance that would burn the body through the clothes.

I have here a gas mask—a British gas mask, and here I have our own that has been improved since the War. After the first gas attack, the British very soon had a gas mask, very crude, but affording suitable protection. Of course, all the other armies likewise soon had masks which would protect against any gas that had to be breathed into the lungs to produce its effect. So the only casualties that result from a gas of the type that must be breathed in order to produce a casualty are those resulting when the gas is put over so quickly that soldiers haven't time to put their gas masks on to avoid breathing the gas. Well, with good gas discipline, you can see that the enemy would get very few casualties—with guards on day and night and gas alarms ready to be sounded whenever an attack started.

This mustard gas, on the other hand, would burn through the clothes, and if persons were in an area where this was scattered around on the ground, they would become casualties whether they had on the gas masks or not.

The Germans first used mustard gas in July, 1917. The British had already experimented with it, as I stated, fifty years before and knew something about it. They knew what it was immediately after it was fired. There is a very interesting point here for technical men—it has a very interesting application to our national defense. The Allies knew what this gas was. They had data from experiments conducted fifty years preceding 1914. They started at once to try to manufacture this gas in order to fire it back at the Germans. They had the foremost chemists on the Allied side concentrated on the problem. I might ask how long it

took them to develop the process of manufacture—how long would you say from a technical man's view-point?

Remember, they knew what it was. This is a very interesting question, I think, because it has to do with what may happen in the future. The French were losing several thousand men a day from mustard gas casualties and they were desperate—the British losses from this cause were likewise heavy — they had to do something.

Well (to answer the question) it took a full year. The first mustard gas shell was fired back by the Allies in July, 1918. It took a full year to get ready.

You know that when the submarine menace was at its height, people expected the problem of detecting submarines and destroying them to be solved right away. The government was going to get Thomas A. Edison, and he was going to solve that problem almost overnight. The people had confidence in him as a miracle man. I don't mean to reflect on Thomas A. Edison, but problems of that kind, in many cases, are just not solvable even by supermen in less than a certain minimum length of time and that minimum may stretch out to months or years—it takes a minimum length of time for even a genius to accomplish certain technical results. The irreducible minimum of time may in critical situations seem appallingly long.

That is illustrative of the necessity for anticipatory planning and preparation. A nation cannot make up by intensity of effort for failure to be previously prepared or expect to accomplish in weeks or months the work that should have been done over a period of years. You cannot construct a battleship in less than a number of years, no matter how urgent the need nor under what high pressure you may work. In the same way, there are important research and development problems that you just can't carry out overnight even by high-pressure investigation and research.

As an example, if the Germans, in the Franco-Prussian War, had fired one of the mustard gas shells at the start of the war, and the French had then started research in order to be able to fire one back, they would have been able to fire the first shell only at the end of the Franco-Prussian War. We thus have to be on the alert in time of peace. Any nation, if it is caught behind in technical development at the start of a war, may not be able to catch up, no matter if it has all the gold and scientists, and indus-

trial and other resources in the world. It cannot speed up beyond a certain point.

The question may reasonably be asked, "What are the probabilities that a gas will be discovered that will wipe out whole populations and will be much more effective than any gas now known?"

First, let us ask what was the most effective war gas used during the World War. Mustard gas was by far the most effective gas used during the War. Since it burns the body through the uniform, you can see, for example, that if you fired this gas into the Argonne Forest, troops would have to get out of that area or would over a period of hours find burns developing over their bodies.

As an example, one of the battalions of the 18th Infantry went into the Argonne Forest north of Charpentey on October 1, 1918, a thousand strong, relieving a battalion of the 35th Division. The next morning forty per cent. of the soldiers had to be evacuated because they had lain on the ground where mustard gas was present; even though not in a quantity sufficient to be readily detected. Think of it—400 out of 1,000. That shows the effectiveness of mustard gas.

But the injuries caused by this gas are not in general serious. Soldiers are as a rule burned but slightly about the body and are laid up as casualties for several weeks.

In Villers Tournelle, on the night of May 3-4, 1918, just in front of Cantigny, the 18th Infantry of our First Division had 700 casualties. As an example of the slightness of the injuries which yet disabled men, I saw a Captain come up to the Colonel crying. He was burned so that he walked with difficulty. He was weeping because he didn't want to go back to the hospital. For the time being he was as much a casualty as if his leg had been shot off, although he was really but slightly injured.

Now the question comes up as to whether or not there will be a chemical agent more effective than mustard gas discovered for a future war, whether or not we may look for something far more deadly. Strange as the statement may seem to you, gas as used during the World War was not at all deadly.

Of the casualties from gas among the American troops, only two per cent. died. We were speaking outside this evening about the horrors of gas warfare. There is a great deal of misapprehension about that. As Josh Billings said, it isn't so much what people

don't know, but the great amount of information they have which isn't so that puts them on the wrong course.

What people know about chemical warfare is nearly all wrong, because it is based on propaganda. The Allies were the source of most of our information during the World War. In a recent number of *Foreign Affairs,* a study had been made of the sources of the information contained on the front page of the *New York Times* during the World War. The author plotted a curve showing that the greatest proportion of our information during the World War came from France and Great Britain. Naturally, we got France's and Great Britain's points of view. I am not reflecting on them. They colored the news in a way which would suit what they considered their war aims and purposes. All nations act similarly with reference to propaganda where they control the means of disseminating news.

When Sargent painted his picture of the gassed and sightless soldier to create a feeling against the Germans for having instituted chemical warfare, he might much more truthfully have pictured a soldier with his entrails torn out by a high explosive shell or blinded by a machine gun bullet, because practically all cases of serious injury, including blindness, were caused by missiles and practically none by gas. In our army 24 per cent. of those wounded by all means died; 36 per cent. in the British Army, and 43 per cent. in the German Army. Only 2 per cent. of those in our army that were gassed died. A gassed soldier had twelve times the chance of living than if he had been wounded otherwise. It is very interesting that in each one of those armies—it works out approximately the same—a soldier had twelve times the chance of surviving if he were wounded by gas than if he were wounded otherwise. I might add that in the German Army a gassed man's chances of living were fifteen times that of one wounded by other means; the Germans had fine gas discipline and therefore relatively few serious gas casualties.

We think of a soldier having to suffer gas attacks on the lungs. He should not have to if he is a good soldier, because very soon after the World War began a gas mask was developed in all armies which gave the lungs complete protection against gas. There may be some fellow here whose lungs were gassed. Well, in your case it wasn't lack of intelligence or discipline (laughter), but in general it is true that a lung case is due to lack of training

or gas discipline. A man putting on his mask is completely protected as to his face and lungs.

In many cases casualties resulted because of ignorance or inefficiency of officers. It has been estimated that 75 per cent. of our gas casualties were due to the officer in command at the place and time not knowing his job, not giving the commands that he should have given, not putting the men where he should have put them. General Gilchrist came to this conclusion after a study of several thousand gassed cases.

As I have explained, in general, a soldier should not get gassed, in so far as his lungs are concerned. Also, you do not have to worry about tuberculosis from gas—we have complete protection for the lungs and even if gas enters the lungs, experience indicates that tuberculosis seldom results. If we could only have protection against machine-gun bullets and high explosives as well as we have for the face and lungs against gas, what a wonderful achievement it would be!

When it comes to burning a man's body, protection cannot be guaranteed, but that has a saving feature. When he is burned, the injury usually is slight. This injury, though slight, takes the soldier out of the fighting line and he requires six weeks or so to recover. There is an advantage in that from the standpoint of engineering. It takes four men to take care of that fellow in the matter of transportation, hospitalization and other attention he may require until recovered. If you put a thousand men out by killing them, a few men, as you know from the engineering standpoint, can put them under with spades. But if you wound a thousand soldiers by gas, four thousand soldiers are occupied in caring for them for several weeks. From an engineering standpoint it is thus better not to kill men, and also from the standpoint that you have to live with these fellows afterwards, it is better not to hurt them unduly. It is also much more of an immediate handicap to the enemy when you injure them slightly. You lay a greater burden on their supply, transportation and other establishments.

As a matter of fact, the scientists responsible for chemical warfare have done more to humanize war than all the conventions for this purpose held through the centuries. They did not intend this. They intended solely to overcome the other fellow, but in the process, in so far as we can tell now, they have developed a weapon with which it will be very difficult to injure seriously a man in the future.

I am speaking sincerely—it would be very difficult to injure a soldier seriously with gas. It would be practically impossible among disciplined soldiers to cause a death by means of gas. Possibly someone can explain how gas could kill a soldier equipped with a mask and disciplined—maybe they can, but I can't. If the soldier puts his gas mask on, mustard gas can only burn him, and can do that in general only to a mild degree if he takes adequate precautions.

So far as we know, there have been no outstanding discoveries of new chemical warfare agents since the World War. There is, however, always the possibility that a gas may be or has been discovered that will penetrate all gas masks. Now, what is the probability? The League of Nations appointed a committee of internationally famous scientists to determine that possibility; to make a study of it. Their statement was that the mathematical probability of discovering a new gas of a highly destructive nature is very remote.

During the War the Allies tested about 1,000 compounds out of about 800,000 they could have tested. They came down to one that was finally most useful tactically, mustard gas. It is possible, however, that in the future, either by chance or through purpose, a far more effective chemical warfare agent may be discovered.

J. B. S. Haldane (a noted British scientist—and he was also a captain in the Black Watch in the World War, and afterwards in the experimental end of the Chemical Warfare Service) says that we know most of the physical facts about the lighter, more poisonous compounds, such as prussic acid. We know how to protect against these. The heavy molecular substances that we don't know so much about are more easily protected against. The charcoal in the canister protects against most of them. So, the more toxic chemical agents are in general well known and protection provided for them, while those that we do not know about are the most easily protected against.

The principal new development since the War is the spraying of chemicals from airplanes. That, along with other things that the airplane will do, is going to change the whole situation in war. We believe that the back areas now are going to get more chemicals than the front-line troops. If you can keep supplies from going forward, keep the depots from operating, and thus keep the enemy troops from receiving the things they need, you won't need

to beat them—they will be rendered impotent in due time. So the chemical attacks will tend to be on the back areas, the depots, where the engineers are working. I don't mean that engineers don't work up in the front, but the principal effect of chemical attack is going to be where some of you did much of your work in France—in the depot areas. Over there you suffered no gas attacks in the rear areas. A future war will see this condition changed.

There is always the possibility, however, that somebody may discover a gas that will penetrate our masks. This involves the principle of surprise, which is one of the outstanding principles of war. If a man behind the laboratory walls should discover something that would practically nullify all your war preparations, you would have a marked example of the principle of surprise. A gas that would penetrate the gas mask would do this. It isn't probable. But you have one example where this was nearly done. The British had made a discovery in 1918 which would have enabled them to have penetrated the German mask in 1919 had the war continued.

There was an article in the *Saturday Evening Post* on chemical warfare written by Emil Ludwig, in which he wiped out all the people of New York City with diphenylchlorarsine. Here it is in these capsules. During the World War it was used in the German Blue Cross Shell. There were thousands of those shells fired at us, and not a severe casualty resulted from it. Hans Gesner, writing in *The Forum*, also wiped out seven million people with this gas.

Ordinarily, if a man is interested, I get him to breathe this gas. The *Brooklyn Eagle* correspondent came down to the Island to write an article on chemical warfare for the Sunday edition of the paper. I told him he could get in on the ground floor and have basic information by breathing the chemical that Emil Ludwig used in imagination to kill off all the people in New York. I have a little generator here that heats the chemical and puts it off as a gas. If anybody is interested, he may try it now. It won't hurt you seriously. If you breathe enough of it, its effect corresponds to seasickness. Not a comfortable experience, but not dangerous. After the *Brooklyn Eagle* correspondent breathed the gas for a moment, he stuck his head out of the window and said, "By George, I think Ludwig was right." (Laughter.) However, he was feeling fit in about an hour and was glad he had undergone the experience.

The Germans put this over in artillery shells. They put it in a bottle in the shell and the high explosive scattered it as small particles in the air. It was intended to have it pass through the charcoal and thus tend to make a man seasick, when he would pull his mask off and get a full dose of whatever gas was in the air. Careful experiments after the War showed that the particles were not small enough to pass through the charcoal readily. The casualties from this gas were therefore few.

In a British dugout some men by accident dropped some of this chemical on a hot stove. The resulting gas cleaned out the dugout. Thus by accident they found that vaporizing the gas by heat made it far more effective than when put off by explosion—it is just one of those things that was discovered by chance. So the British put smokeless powder in a container and this stuff at the top. The smokeless powder was granulated in such a way that instead of exploding it would burn—the pressure was not sufficient to make it explode. The heat of the burning powder vaporized the chemical and the particles were so fine that they penetrated the gas mask canister of the war period.

Had the British perfected this method, they could have reproduced the situation that prevailed at Ypres on April 22, 1915. They were going to use this method in 1919. Such a development takes a lot of experimenting in the first place. Then there is the construction of the material, and the supply features—all these take a long time in spite of any haste or especial effort that may be made. Had the war continued to 1919, it is probable that all the German gas masks would have been penetrated. Of course, everybody in the world knows about this method now and masks were improved to protect against it.

The CN-DM grenade that is used in riot duty involves the principle that the British developed and were going to apply against the Germans. For riot duty, use is made of a mixture of CN, the tear gas, and DM, the gas that makes you sick at your stomach. When the grenade is thrown, the smokeless powder ignites and burns and thus vaporizes the chemical and sends it off into the atmosphere as a cloud, making all who breathe it sick. You can't possibly kill a man or hurt him seriously with it, but you do make him temporarily seasick.

I have gone over hastily some of these things and I have left out a lot in which you may be interested. For instance, here are a

couple of thermit or incendiary bombs from Abyssinia. They were brought back by a *Herald-Tribune* correspondent. I don't know whether you noticed an article written by Colonel Zanetti, who represented us at Paris during the War and who is Professor of Chemistry at Columbia University and also Colonel of the Reserve Corps. The article was written for the Columbia University faculty paper and was quoted in the *Readers' Digest*. He said that in the future these thermit bombs would be used extensively to destroy cities.

The thermit, when burning, reaches about four times the temperature of molten steel. This one has burned, the other failed to ignite. It has been cut to pieces at the Arsenal to obtain information as to its construction. The bomb container burns also. Scattering these over a city would tend to set so many fires that, due to the number of fires, it would be impractical to put them out. That is theoretically very sound. For instance, in England, Parliament is very much agitated over the protection of the population against aero-chemical attack. It has been stated in Parliament that one enemy bomber could start more fires simultaneously than the whole fire department of London could cope with.

All the world is evaluating this use of incendiaries as a substitute for high explosives. By scattering over a city large numbers of these incendiary bombs, dropping them from planes that do not have to have near the capacity of ordinary bombing planes and which can be speedier, they could set so many fires that the fire departments of the city would not be able to cope with all of them. Colonel Zanetti's views were opposed by a lot of experts when he wrote his article, but it is very interesting to see that European countries are tending to come around to his point of view.

If there are any questions, I would be glad to answer them.

MEMBER: Let's see the gas mask.

COL. GIBSON: The mask that was used during the War had a nose clip and mouthpiece. The British, who developed it, felt that the face-piece could not be made gas tight, that the gas would come in. So, in order to be absolutely sure that the soldier will breathe the air through the canister, they have this tube that he puts right in his mouth, and the clip goes on his nose. This is what you all wore over there—the clip on your nose and the plug

in your mouth. The covering around the face was just a partial protection. We now have this other mask that is gas tight about the face-piece and has no noseclip or mouth-piece.

The sound through this gas mask is muffled. But you could not talk at all with the British gas mask which we used during the War. You can give commands with this. That is a great improvement.

We have five sizes in this mask. However, by considerable experimenting, we have improved the mask so that it can now be built so that one size will fit every contour of face.

Ours is a very expensive mask. It costs more than the infantryman's rifle. It is too expensive and too bulky, we believe. Work is being done to remedy these defects.

Here is the German mask that was used during the War. It is what they use now—practically the same mask. They made a rather simple mask. You see, you have the canister attached to the face-piece. You can renew the canister by unscrewing it in this manner (illustrating). Of course, you have to carry the weight of the canister on the face-piece. You can therefore put only a moderate-sized canister on it, while we can put a large canister in the satchel here. We can thus give longer protection and cut down the breathing resistance. On the other hand, ours is very expensive. And if you go through deep water with ours it would be immediately put out of commission—the water flooding the canister.

All the German soldiers and civilians are being supplied with masks. The British are buying thirty million gas masks for their population. I have here a booklet showing the little German children drilling in masks. This indicates how seriously the people of Europe are taking this problem.

You know, each country issues a monthly periodical on this subject. We used to have a journal on bicycling and after that a journal on automobiling. Similarly, every country in Europe has a periodical on aero-chemical defense. I have here one from every country in Europe. One of the best illustrative magazines in Europe is the German *The Sirene*, which is given up wholly to aero-chemical defense.

Switzerland has gotten out a series of about five or six manuals informing her people on aero-chemical warfare. All this will give you some idea of what the situation is over there.

However, so long as our navy prevents anybody from coming near our coast—say within 500 miles—we do not have to worry about aero-chemical attack.

Thank you very much, gentlemen. (Applause.)

PRESIDENT WENDT: Colonel, we thank you for a most interesting address, and we appreciate having you as our guest this evening.

Now, gentlemen, the hour is late and I declare the meeting adjourned.

. . . The meeting adjourned at eleven-forty o'clock. . . .